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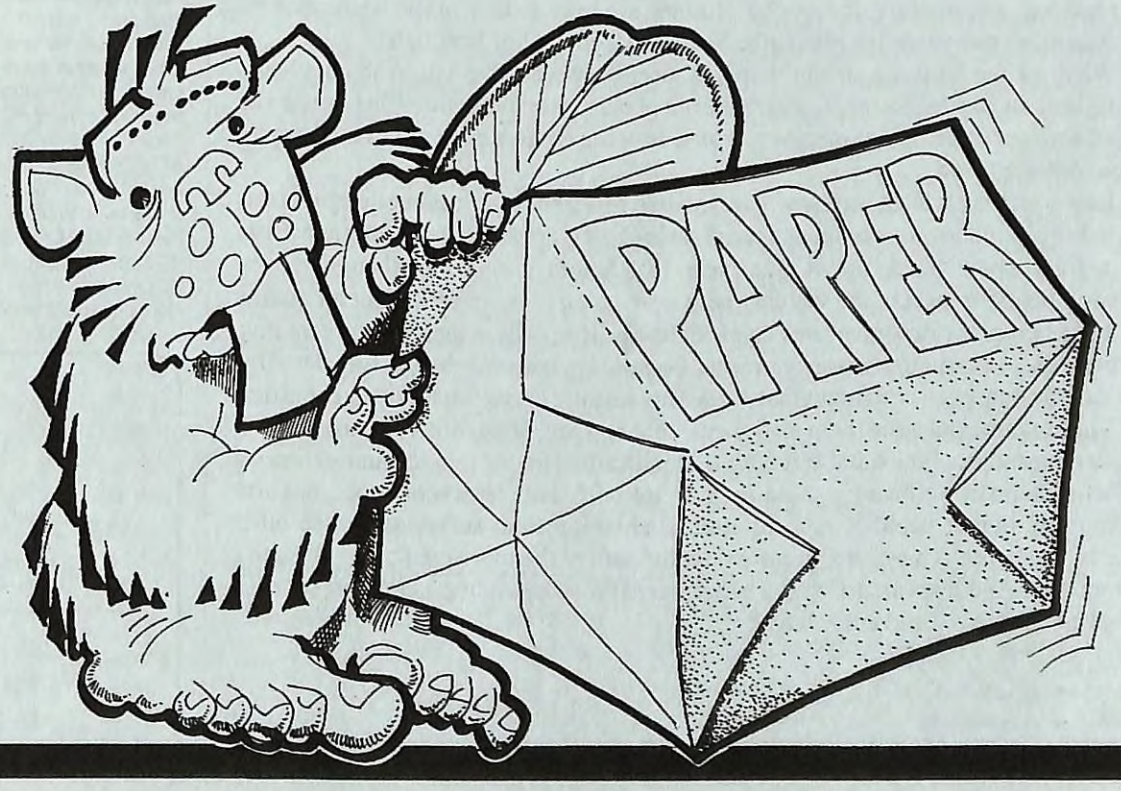
Building Paper



From the Editor . . .

Environmental issues may not be in the headlines at the moment, but they can't be swept under the carpet. The issues are still there.

The building industry is one of the biggest culprits contributing to environmental degradation, so any actions we can take will be positive. Our industry's impact is not just the direct effect of high profile developments that so often attract public attention (and bring out all the NIMBYs). The local subdivision that has denuded a forested hillside, or the project that endangers a trout spawning creek is, after all, something that with care, attention and design revision can preserve some aspects of the site to minimize environmental impacts.

More serious is the impact of actions we take that we don't see. The lifestyle effects of a project design and the products used can have an effect we may not be aware of on the job site. The extraction, manufacture, packaging and shipping of products always entail environmental impacts. Some are more harmful than others, depending on the nature of the raw material, the kind of processing needed, the energy input to produce the product, the recyclability of the materials, etc.

We may have a concern but most of us don't have the knowledge about the environmental impact of various products. Sometimes, it's only after a severe situation develops that we learn about a problem. Who really gave thought to old tires, until the mountains of tires at dump sites started to burn? Who seriously gave any thought about waste management, before we had the image of barges towing garbage with no place to dump it because the landfills were full? Who thought about energy conservation before OPEC threatened to turn off the tap on the oil pipelines? Who thought that our forest resources were, in fact, limited before the environmental movement stated to ring alarm bells about unsustainable forestry practices?

The correct steps to take, to be more environmentally responsible, are not as simple as replacing one material for another. Rather, we have to look at the whole system, including, as one yardstick, the embodied energy content of materials.

What got me thinking about this was a recent newscast that talked about a house being built in Saskatchewan. It was made out of plastic sections assembled on site and filled with concrete. The project was touted as being environmentally sound because it did not use wood.

However, plastic is a non-renewable resource, and some plastic home designs create an unhealthy indoor environment. I recall seeing that type of system not long ago. Even as a trade show mock up, it was clear that before giving any thought to the environmental impact of the system, there were going to be severe indoor air quality problems since the design creates an air tight envelope. The company representative indicated that ventilation was not an issue, because the house on display was slated for export. Evidently, they thought that air quality was not a concern for other countries.

The fundamental issue is not just whether or not wood, or any other material for that matter, is used, but how suitable it is for the application, taking into account all aspects affecting human wellbeing - these include not only short term economics, but also liveability, indoor health issues, as well as environmental sustainability. In other words, the house is a system, greater than the sum of the individual parts. We can't forget that! And if we are to leave a better world for succeeding generations, we have to take action now, and every day.

Richard Kadulski
Editor

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Building Papers

Building Papers, or house wraps, are used behind the finish siding material to provide a weather barrier which protects the interior components of a wall from rain, snow, and wind that can penetrate behind the exterior siding.

Traditionally this has meant an asphalt paper but new products available today are also sometimes used as an air barrier (e.g. Tyvek, Typar, Air-Guard).

Recently failures of building papers have been observed in B.C. Such a failure can lead to moisture penetration into the wall and structure, leading to structural deterioration. Most of the failures have been associated with stucco finishes, often improperly applied. Too often, the assumption is made that the stucco is a waterproof finish, which it is not. Unlike siding or brick veneer, it is not as easy to provide a rain screen cavity behind the exterior finish, which would reduce water induced problems.

What is building paper?

Typically it is a strong kraft paper which has been passed through a hot dip of liquid asphalt. The hot asphalt coats all of the paper fibres and fills the spaces between them. The degree of saturation is controlled so that the paper emerges from the dip with no excess coating to ensure that the fibres can breathe. (Many years ago coal-tar was used, hence the name "tar paper". This is no longer permitted.)

House wraps are made from polyethylene or polypropylene strands manufactured into sheets.

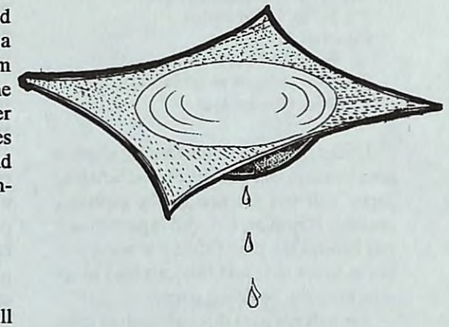
Concerns have been raised that the paper membranes are contributing to the rotting problems that have occurred in wood structures recently. A definitive answer is not yet available. The suggestion has also been made that building designs and construction methods used today are probably more to blame. In addition, the use of untreated oriented strand board (OSB) board may also be a contributor, as plywood and shiplap seem to be more resistant to rotting. In OSB the wood wafers are layered onto each other resulting in a network of small crevices and spaces where water can penetrate and remain, allowing for biological organisms to breed.

How does building paper act as a breather sheet?

Paper is an organic material and will always absorb moisture until it is in equilibrium with its environment. For example if the humidity on one side of the sheet is high it will absorb moisture from that side and if the humidity on the other side of the sheet is lower it will give off moisture to that side. Because of the asphaltic coating this process occurs at a relatively slow and controlled rate. The rate of flow of water molecules through a material is called "permeance" .

In the case of house wraps, the sheets are woven or thermally bonded into a fabric that has microscopic perforations that allow vapour transmission, but are tight enough to resist bulk moisture flows.

Water will not leak through building paper even under a significant pressure head. However, a process called "wicking" can take place allowing "dampness" to occur on the side opposite to the wet side. Wicking can occur with any sheathing material including synthetic house-wrap fabric.



Water resistance is measured by floating a piece of building paper, edges turned up on a dish of distilled water. Dye is placed on top of the sheet and when the top side of the sheet is sufficiently damp, the dye will begin to turn colour. The time for a colour change to occur is its "water resistance".

Sheathing papers have to meet CGSB standard CAN 2-51, 32-M77. Unfortunately, too few people understand what the standard covers. Contrary to expectations, there is NO mention in the standard for any level of water resistance. The only tests that apply cover water *vapour permeance* and *tensile strength* of the paper.

In the U.S.A. building codes now require a water resistance of 10 minutes for sheathing papers, although some states require up to one hour of water resistance hence the development of "one hour" building paper.

Contrary to expectations CGSB standard CAN 2-51, 32-M77 does NOT address water resistance - only water permeance and paper tensile strength.

Typical water resistance measurements are:

Regular grade building paper:
10 to 30 minutes
Heavy duty building paper:
60 to 150 minutes
Breather felt paper:
over 24 hours
Synthetic house wrap fabric:
9 to 10 minutes

Under normal circumstances, where it goes through wet and dry cycles, building paper will not rot due to the asphaltic coating. However, if a wall is perpetually wet behind the paper then the wood will begin to rot first and this can lead to rot attacking the building paper.

Air will not pass through asphalt saturated paper so it could be an air barrier. However, to be effective as an air barrier, all joints would have to be sealed either with tape or with an asphaltic cement and all penetrating fasteners would have to be sealed. This is also the case with synthetic house wrap fabrics.

Should asphalt building paper be used for flashing around door and window frames?

A better material to use is flashing paper. This is a reinforced sheet consisting of two layers of kraft paper laminated together with asphalt and reinforced with fibreglass scrim. This material is waterproof and also a vapour retarder. Other materials that can be used include a self-adhesive membrane with a foil or polyethylene surface.

Whatever material is used it must be installed to shed moisture to the outer surface of the breather membrane.

In the coastal area of B.C., where water problems have led to serious problems, especially with stucco finishes, standard practice has been to use the cheapest building paper product, (a 10 minute paper). This accounts for probably 90% of the building paper market.

A heavier 30 minute paper is used less than 10% of the time. A much heavier paper (60 minutes or more) is used rarely even though it may only be 1 cent per square foot extra. ($12.00/roll compared to $8.00 for the cheap stuff). In the U.S.A. building codes require a minimum water resistance of 10 minutes for sheathing papers, while some states require up to one hour of water resistance. ☼

Did You Really Shut It Off?

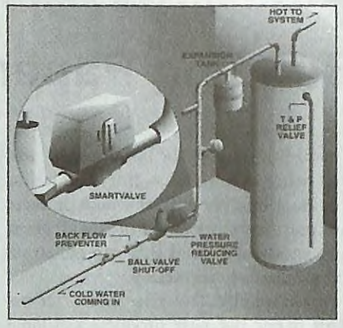
You've done everything to reduce energy consumption. You're leaving the house and you've turned all the lights and appliances off.

So why is the electric meter still ticking merrily?

Many modern appliances we use today consume power as long as they are plugged in - even when "OFF". In other words, use it or not, plug it in and you're using electricity.

Rob Dumont estimates that average annual consumption for all household appliances can add up to about 438 kwh per year. Typical appliance consumption (when turned OFF) are shown in the table.

Appliance	Power draw (watts)
VCR	10
TV	8
Doorbell	5
Thermostat	4
Dustbuster	4
CD	3
Microwave oven	3
Casssette deck	2
Clock radio	2



Smart Valves: Intelligent water valves.

First Smart Sensor Corp has developed what is claimed to be the first product that uses both electronics and plumbing hardware to control water leaks. The controller is designed to detect moisture or water overflow as a result of broken water pipes, basement flooding, sump pump failure or any similar water hazards.

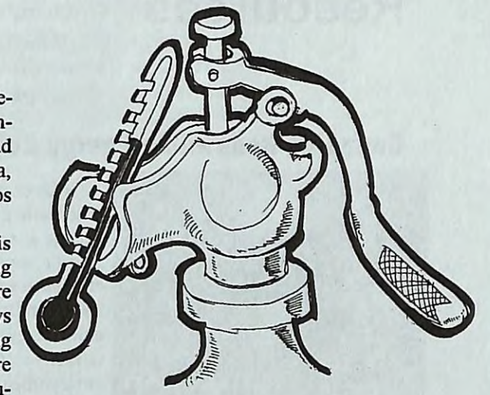
Upon alarm the 2-way balanced hydronic valve will activate an audible alarm; identify the problem area and shut off your main water supply. The message can be transmitted by remote radio frequency; powerline carrier, or hardwired, and single or multiple sensors per valve. It is easy to install with a wireless system, and it can be both stand alone or interfaced to other controls. Up to four zones can be controlled. Each zone has an indicator light that will switch on when water is detected by any of the remote sensors.

Once activated the valve will remain closed, restricting the flow of water until the unwanted water has been removed and the reset button is pressed. Potential benefits include reduction of the hazards and damage associated with water leaks, and conserves water.

They can be easily installed into an existing water system.

For information:
First Smart Sensor Corp. Suite 201,
1460 Pandosy Street
Kelowna, B.C. V1Y 1P3
Tel: (604) 763-5694
Fax: (604) 763-7113

Heat Pumps



Heat pumps have been used for many years. We commonly refer to them by their application usually for cooling (air conditioning or refrigeration). Every house has at least one small unit (the refrigerator). They can also be used for heating. Their value lies in the comfort they provide in an energy efficient and environmentally sustainable manner, and in many cases cost effectively.

A heat pump extracts heat from a source at low temperature and discharges it at a higher temperature. This allows the heat pump to supply more heat than the equivalent energy supplied to the heat pump. For 1 kwh of energy, the unit can deliver 2 or 3 kwh of heat. It's not a magic process but rather the concentration of heat to where it is most useful. Heat pump cycles can be reversed, so that they could provide cooling in summer and heating in winter.

This dual function of the heat pump is the main reason for its massive worldwide sales. While up to now the emphasis has been on cooling, some countries have ambitious plans to expand their use for heating as well.

There is a wide range of residential heat pumps on the market. Not counting refrigerators, about 8 million units in all sizes and prices are sold worldwide every year. They are used for cooling, heating, de-humidification or domestic water heating - or any combination of these. They may be electrically driven or gas fired. The heat source they use may be the ground, water, ambient air, ventilation air or even industrial waste heat flows.

Central heat pumps are commonly used in North America and typically attached to forced warm air heating systems, so that cool air is distributed in the summer. Outdoor air is used as the heat source to provide summer cooling (air-air heat pumps) , but at below freezing temperatures there is no heat available, so the unit would act as a resistance heater.

Heat pumps sell where there is a cooling demand either due to climate or lifestyle. New developments include performance improvements, gas technology, and ground coupling, especially in Canada, where a growing proportion of heat pumps are ground source.

A major concern with heat pumps is that they still use are ozone depleting HCFC 22 as refrigerants. While these are contained in closed loops, there is always the concern for leakage, especially during servicing. Regulations now in effect are phasing out the use of HCFC and manufacturers are looking at alternatives.

Where there is no cooling load, just a heating load, the heat pump has a tougher challenge. The installation of a heating-only heat pump requires special skills which may not always be available among heating contractors. Poorly sized and wrongly installed heat pumps will lead to problems.

A successful installation requires an excellent control system, proper sizing, and a skilful installer. Unlike fossil fuel or resistance heaters which operate independent of outdoor conditions and can in principle be easily controlled for optimum comfort, heat pumps, especially air-to-air systems, are affected by outdoor conditions, so control is more complex. Fossil fuel or resistance heaters can be over-sized without too much of a penalty in investment costs or part-load performance but that is not the case with heat pumps. For heat pumps, over-sizing is costly and potentially detrimental to performance under normal conditions

In the case of air-to-air heat pumps, at outdoor temperatures below freezing, the unit effectively works as a resistance heater. That is why so many central air conditioners are linked to conventional furnaces and designed for cooling only.

Costs have hampered the market penetration of the heat-only heat pump as capital costs are still relatively high. With current low energy prices the energy savings translate only into modest operating cost savings.

Canada and the northern US offer excellent conditions for earth coupled or ground source heat pumps. The full economic benefit of the technology can be offered year round, as below grade temperatures remain above freezing, so that a coil in the ground will always provide a source of heat in the heating season, and a heat sink in the summer.

How are heat pumps used in other countries?

About 260,000 heat pumps are currently installed in Sweden, where they have been in use for thirty years. Most heat pumps now are liquid-to-water heat pumps, which use the ground, rock, ground-water or lakes as heat resource to heat water for hydronic heat distribution.

Switzerland has a programme that calls for 3% of space heating requirements to be supplied by renewable energy sources by the year 2000. This means that 100,000 heat pumps will have to be installed in the next 5 years. At present, there are 43,000 heat pumps are in use. One in four new private houses is heated with a heat pump.

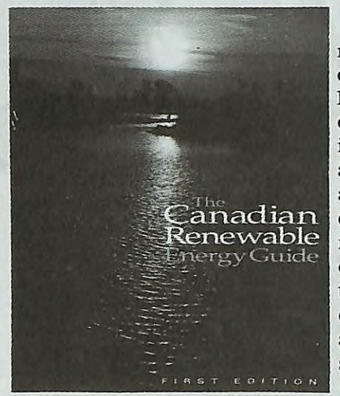
In Japan small room air conditioners dominate the market. About 50% of all households now have at least one in-

Continued on page 8

Resources

Living in an information age as we are, we often are swamped by too much of it. At other times, there's not enough, or it's hard to find, especially when we are looking for new technologies, products, standards or whatever. This month we're reviewing several new resources that will be of interest.

Canadian Renewable Energy Guide



Solar energy, wind energy and other renewable energy options are experiencing a renaissance in the 1990's. Lower equipment costs, higher efficiencies, and improvements in quality and reliability are making renewable energy applications economically attractive. As well growing global environmental concern is emphasizing the need to reduce our dependence on environmentally damaging conventional energy. More than ever before, environmental and economic forces are making renewable energy an essential component of every project.

At the same time there is a need for up to date information on available technologies, products and services. The problem for someone looking for these products is where to get that information.

To meet the growing demand for information, the **Solar Energy Society of Canada Inc**. has produced The Canadian Renewable Energy Guide.

The 248 page Guide (a bargain at $24.95) shows you how to take advantage of solar, wind, micro-hydro, biomass and geothermal energy for everyday applications in homes, cottages, farms, remote sites, transportation and industry.

It provides: renewable energy applications and solutions appropriate to Canada; easy-to-understand explanations of the technologies and informative case studies that include low-energy homes, remote location solar generated electricity; solar space heating, cooling and water heating; grain drying, grid-connected wind farms, and more.

Most important is a comprehensive directory of products, services and Canadian companies supplying the essential products, as well as contacts and sources for information and advice.

***The Canadian Renewable Energy Guide** is published by General Store Publishing House, and should be available in many bookstores or can be ordered directly from the publisher.*
Tel: 1-800-465-6072
Fax: 613-432-7184

Direct orders are $24.95 plus $5.00 for GST, shipping and handling.

Ontario Green Products List, First Edition

We were most impressed by this publication. This is a list that has names products, suppliers and services that have been identified as being "green", which are defined as energy efficient, or water conserving, or reduce waste or pollution, or they represent a non-toxic alternative or otherwise contribute to a healthy environment.

The list focuses on Ontario made products only, except where there is no Ontario manufacturer or if the product has superior "green" benefits. Product listings include a rating that considers a product's "greenness", location factors, and cost.

Product types listed include:

Mechanical systems: heating and cooling system equipment, controls, ventilation equipment, air cleaners and filters, gas/propane fireplaces.

Household appliances: plumbing fixtures and renewable energy products

Building materials: insulation, weatherstripping and air sealing products, paints and finishes, windows and doors.

The entries contain manufacturer information, approximate price information, and product description. The list does contain a disclaimer that the first edition may not be comprehensive or exhaustive, and feedback for future editions is welcomed.

Anyone wanting to source environmentally responsible products would find this an easy to use and worthwhile reference even if they are not in Ontario. Unfortunately, we have not yet received information on how (or if) the publication will be distributed. Ontario residents interested in seeing a copy should contact their local Green Community group. Otherwise, you can contact us and we will forward your name once we get more information.☼

Housing Energy Design

This book presents a comprehensive approach to the design of energy efficient housing.

This is a companion to the CHBA Builders Manual and HOT 2000 software program. Its aim is to assist designers to better deal with the possibilities made available with recent advances in window technology and proven building technologies.

The target audience is students of residential architecture and practitioners "who have remained students at heart".

As a design book, the focus is decidedly on the energy aspects. HOT 2000 users will find useful information on how to take full advantage of the software. The material goes beyond that contained in the user manual (although most of the illustrations are the same ones).

Contents include an overview of energy efficient housing design within the broader context of sustainable development; key elements of building science and how these are applied within the house as a system approach to design and criteria for selecting appropriate building envelope and mechanical systems. Perhaps most valuable is a complete illustrated example using the HOT 2000 software.

This book will be of use for anyone that wants to take a serious look at energy efficient design.

The authors, principals of habitechnica, a Toronto consulting engineering firm, have been actively involved with energy efficient design for many years and they also teach at Ryerson Polytechnic University.

Copies are available for $40 - (students $30) plus $4 shipping . Habitechnica, 88 Prince Arthur Ave Toronto, ON M5R 1B6 Fax: 416-975-8819

Guide to Resource Efficient Building Elements Fifth Edition.

This directory of recycled building materials and construction products that make efficient use of primary resources has been updated and expanded each year since its first publication in 1991.

The new Fifth Edition provides contact information for more than 400 manufacturers of building products, and features revised text that discusses issues of resource efficiency as they relate to each type of building component. Also included is the yardstick used for evaluating building materials, so that readers can apply the criteria to materials selection for their own building projects.

The book contains thirteen chapters of manufacturer references with product descriptions, including sections devoted to Foundations, Framing, Roofing and Floor Coverings.

Information is presented on innovative products such as cotton insulation, recycled plastic lumber, compressed straw panels, honeycomb paper panels, formaldehyde-free fibreboard and engineered lumber.

Chapters on the management of resources used in construction familiarize readers with some of the environmental impacts of resource extraction, and the implications of long-term resource use. Information on job-site materials recycling and waste prevention is also provided.

Copies are available from CRBT for (US$) $25, plus $3 shipping and handling. CBRT, P.O. Box 100 Missoula, MT 59806
Tel: (406) 549-7678 Fax: (406) 549-4100

The Clean Air Guide

This was the first publication on clean indoor air to be released. Over 90,000 copies have been distributed and the demand for it continues as people become more aware of the role of the indoor environments on occupant health. The guide helps the homeowner or apartment renter to assess the indoor air quality in a dwelling. To identify sources of pollutants, an audit can be made using the checklists. Options for correcting the problems are listed.

A companion video, "This Clean House", has just been released. It shows how homeowners can identify and correct indoor air quality problems. Expert interviews with physicians and researchers substantiate concerns on dampness, moulds, and other indoor pollutants. The video discusses treatment of backdrafting from combustion appliances and ventilation in the home.

If you haven't seen either, it is well worth your while to do so. Not only are these materials good as a refresher of the topic, they also can be used to help market the ideas to homeowners whether for a new house or renovation project.

Copies are available from CMHC. Tel: 613-748-2367; Fax 613-748-4069 or 1-800-668-CMHC

Frame Plus

This is a powerful, sophisticated software, not for the fainthearted. It incorporates the VISION and FRAME programs which are recognized world wide and are used by window manufacturers to prove compliance with CSA window standards.

The software has now been packaged into a single unit, and can be used as a tool to calculate and simulate the thermal performance of any building envelope component. The real power is that it considers the detailed heat flows through all components of an envelope, breaking down the elements into very precise components. In other words, not just taking average R values of the different materials, and averaging their values as is used for normal heat loss calculations. Rather, the inputs are precise, taking into account every change in thickness (e.g. including variable profiles of mouldings, window and door frames). For normal, day to day use this level of calculation is not needed. But where you have elements with components that have variable dimensions, for example, innovative building assemblies with irregular profiles or insulating concrete forming systems with variable cross sections that cannot be easily modelled using conventional approaches, this package provides an effective tool.

This software can be used as an alternative to actual laboratory testing of building elements.

Frame Plus is not for the casual user, but for researchers and academics. Industry can take advantage of this tool to get answers on performance by simulation more cheaply than doing full scale testing of total assemblies. In addition to the software user manual, there are workbooks that take the user through example calculations.

For information: Enermodal Engineering, Waterloo, ON.
Tel. 5 19-884-6421 Fax 519-884-0103
e-mail: office@enermodal.com

Home*made Money:* How to Save Energy and Dollars in Your Home

by Richard Heede and the staff of the Rocky Mountain Institute.

This is a thorough re-write of Practical Home Energy Savings, first published in 1990. It is written in a direct, accessible style for homeowners, renters, and building operators, telling which home energy saving measures make economic and environmental sense, where to get the necessary materials, equipment, or help and how to complete the project. Many cost-effective ideas that conserve household energy use while saving money are offered. Hundreds of practical ideas and measures are explained to help householders reduce energy costs by as much as 30% without a great deal of effort. The authors keep it simple and organize their advice by economic priorities, making this do-it-yourself guide a good tool for homeowners and home builders alike.

Cost-effective tips are prioritized by energy saving measures, based on the biggest bang for the buck. There are also lists of manufacturers, trade associations, mail-order houses, state energy offices, regional energy groups, training centres, books, journals, and videos. All source listings are US sources, so they may be of limited use for Canadian readers. However, it could be a useful tool for builders and homeowners.

Homemade Money (US $14.95)
Rocky Mountain Institute, 1739 Snowmass Creek Rd., Snowmass, CO 81654-9199, Tel (970) 927-3851

Continued from page 5

stalled. Heat pump sales hit an all time high in 1994, with over 5.6 million units shipped. Sales were helped by a modest economic revival and by a hot summer.

In Central and Northern Europe, there is very little residential cooling demand, so heat pumps are typically used for heating only. In Austria and Germany hot water heat pumps are commonly used.

The residential heat pump market in Canada has recently seen annual sales between 18,000 and 30,000 units. Air-source heat pumps (air conditioners) remain the dominant technology, but ground-source applications are seeing significant growth, with 3,000 to 5,000 ground-source heat pumps installed each year. ☼

Thoughts to consider about home heating:

- Direct combustion to generate heat is not always the most efficient way to heat a residence.
- Heat pumps are efficient because they can use renewable energy in the form of low-temperature heat.
- When fossil fuels, nuclear energy, or renewable power is used to generate electricity, electric heat pumps make far better use of these resources than resistance heaters.
- The fuel consumption, and consequently the emissions rate, of an absorption or gas-engine heat pump is about 35% less than that of a conventional boiler.

R-2000 Energy Credits

The R-2000 Program uses a formula to calculate the allowable energy consumption target for new houses. The formula takes into account the size of the house, the location (climatic data) and heating fuel type.

Even though there is a move towards more attention to environmental and indoor air quality concerns, energy is still the fundamental element - it is the one that can be measured. Experience has shown that houses meeting the stringent energy targets will also provide the improved indoor environment for the occupants.

In recent years, new mechanical equipment options and performance improvements have become available. However, the HOT-2000 software program, which has the energy target formula built in, has not been able to keep up with all changes. As a result, to keep on top of all innovations within the industry, some manual modifications have to be made.

Furnaces today are often being run continuously to provide continuous ventilation air distribution and air circulation within the house. Unfortunately, most of the furnace fan motors up to now have been terribly inefficient, consuming a lot of power. Based on the extensive monitoring that has been done in recent years, we have a better picture of how much energy various motors are using.

Is it important to know how much power is consumed by a furnace fan? It may seem like nit-picking, but an inefficient motor can easily consume 1800 kwh of electricity per year or more. Some of this energy will show up as heat, which in an energy efficient house could easily be 10% or more of total heat load. At some times of the year, the heat given off the blower motor will actually overheat the house.

In order to more accurately reflect monitored performance, the R-2000 Program has developed energy credits for certain ventilation air distribution systems. The credits have been produced in an attempt to find a realistic middle ground for energy consumed by furnace fans and to give credit to fully ducted ventilation systems. In this way the energy impacts of ventilation air distribution are accurately reflected in the energy consumption targets.

These credits can have an impact on houses that are close to the energy targets; they may make it possible for some houses to meet them without resorting to extreme measures.

Options for which credits are available (and the size of credit) are shown in the table. The fan/motor system described is for the principal equipment used for ventilation.

FAN MOTOR SYSTEM	ELECTRIC FURNACE	MID EFFICIENCY FURNACE	HIGH EFFICIENCY FURNACE
#1. Shaded Pole	-467	-467	-467
#2. PSC running continuously	0	0	0
#3. PSC running automatically	667	495	581
#4. ECM running continuously	467	347	407
#5. Direct ducted HRV (baseboard or bydronic heating)	667	454	560
#6. Transfer fans running continuously	574	404	489
#7. Switched transfer fans	610	462	536

R-2000 Equipment Credits

1. Shaded pole fan motor is rarely used, but still available. This is the old style motor, that is very inefficient, which is why the credit is negative (in other words, there is a penalty applied for this type of equipment).

2. PSC motor, running continuously. This is the default condition as it is the most commonly used furnace fan motor type.

3. PSC motor, running on automatic. In other words, a standard furnace installation with a heat recovery ventilator where supply air is fully ducted, so that the furnace can operate only in automatic mode.

4. ECM motor running continuously, the HRV does not have to be fully ducted to all rooms. (An ECM motor running on automatic does not save any significant amount of energy).

5. Non-forced air heating systems, such as baseboards, hydronic, and radiant heating. Ventilation air has to be fully ducted to all rooms as per CSA F326.

6. Room to room transfer fan (also known as a muffin fan) running continu-

ously. This is a ventilation system that is not often seen, but it will meet the ventilation requirements. Rather than having a fully ducted ventilation system, fresh air is introduced into a central area, and air circulation into individual rooms is provided by small quiet fans (not unlike those seen in a computer) that are wall mounted and relied on to move the air from the hall into the room.

The transfer fans must recirculate air between the closed rooms and an adjacent ventilated space in order to be effective and to meet the intent of CSA F326. For example, a second floor with three bedrooms and one bathroom could have a single exhaust duct from the bathroom and hallway. The principle is that the exhaust will pull air from an area with fresh air supply. The muffin fans then push air into individual rooms. This is an approach that could also be used to serve areas that are difficult to provide with a direct duct.

7. Switched transfer fan - not unlike system #6, but rather than running continuously, there is a switch that is activated when the bedroom door is opened to shut off the fan (the assumption is that if the door is open, you'll get some air flow through the spaces, and don't need to have the fan do its thing).

How to take advantage of the credits? Let's take, for example, an electrically heated house. If the HOT-2000 calculation provides an energy consumption target of 21,000 kWh per year, but you are using a fully ducted heat recovery ventilator, you gain a credit of 667 kWh/yr, so the target is actually 21,667 kWh/yr.

If you take advantage of that special deal for the old technology furnace with the shaded pole motor, then if the energy consumption target as calculated by HOT-2000 is 21,000 kWh per year, the effective target becomes 20,533 kWh/yr.☼

Pre Fab Floor Bridging

Wood makes a flexible framing system. For maximum strength light framing relies on load sharing between framing members. However, it seems that load sharing options are not fully used in standard framing practices which results in some floors having more or less unsatisfactory serviceability.

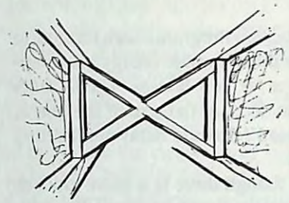
The most common problem is unacceptable bounce and vibration under impact load. This underlines the need for a load sharing design which will result in a stiffer floor.

Floor joist design is governed by three criteria: joist strength against applied loads, deflection under uniform load, and deflection under vibration loads.

Load sharing makes joists work together instead of working separately as is common in many floors. Load sharing systems work by compensating for the differences in strength of separate joists, forcing loaded joists to respond more or less jointly. The stiffer the bridging system, the better floor. This will result in lower stresses on any one piece of framing and less deflection allowing an increase of span under uniform load. Properly done it can mean the span can increase 6 - 8% above present span tables allowances. The span tables in the building code recognize this, allowing greater spans with proper bridging systems.

Under point loading (the most common floor load) a significant reduction of deflection of the floor joists occurs. With proper load sharing and as a result of increased stiffness of the floor, allowable span increases in the order of 12 - 18% above present allowable span tables can be justified.

A new engineered bridging system **NT Bridging** has been developed. Because of its load sharing properties it, is a major contributor to superior floor response. NT Bridging is a proprietary product of Luxor Industrial Corporation. It is a



bridging block designed to fit snugly between the joists so the bridging connection is capable of full moment transfer. Being factory manufactured, they provide an accurate and structural fit as well as providing accurate spacing when laying out joists.

The high racking stiffness of the NT bridging system also increases the load sharing capacity and results in a significant reduction of floor deflection.

These units are especially good for use with wood I joists. These joists offer long spans, but need the extra material to stiffen the web at point loads, walls above, etc.

The elegance of the bridging is that they provide crush blocks as well as bridging. All wood I joist manufacturers provide installation details that require installation of crush blocks used to stiffen the webbs at key loading points. These often require a lot of extra work that can be avoided using a product such as the NT bridging.

When joists are cantilevered, NT bridging can be used to provide an easy and effective air seal (by using a plywood panel against the bridging). This is otherwise a difficult area to achieve an effective air barrier.

There is a cost to these, but if the cost is compared to all the work required to cut blocks and bridging they are a competitive alternative.

For information:
Luxor Industrial Corporation
24611 Fraser Highway
Langley, B.C. V3A 4P6
Tel: (604) 857-9601
Fax: (604) 857-9602

Technical Research Committee News

Canadian Home Builders' Association

Basement Performance Study

Every building is built on a foundation. In most houses in Canada the foundation also forms the basement. Until recently, basements were treated only as cellar spaces, being a necessary part of the structure, but left as an unfinished storage and utility space.

In recent years, we've changed the way we build and use basements, including fully insulating and finishing the area and making it a part of the living space. This change of use means that any imperfections are much more significant - and basement problems are a major problem area.

A study to develop performance guidelines for basement construction is now underway. This project is looking at all factors, starting with a review of first principles, materials, design, and solutions to avoid problems.

The first phase that should be completed by next spring will include identification of performance requirements for basements; identification of basement envelope characteristics; materials selection criteria; quality assurance issues including specification guidelines, designer and builder experience, codes and standards issues; and life cycle costing. Different basement configurations (including slab on grade) are being investigated.

Phase 2, also underway, is more theoretical. It includes computer modelling and component testing of various aspects of basement construction, such as drying and curing times of various concrete formulations; moisture migration properties; impact of various types of insulation, and moisture control strategies (drainage, exterior waterproofing, etc.).

The final phase will include the construction and monitoring of suggested alternative designs.

This project is drawing on the resources of many groups, including Ontario and Atlantic New Home Warranty programs, product manufacturers, as well as research and academic organizations.

Floor Systems Testing Program.

Testing of various engineered wood floor systems is now underway at the National Research Council. Fire and sound transmission characteristics for a number of standard floor assembly configurations are being tested. The intent is to develop ratings that can be listed in Part 9 of the National Building Code. CHBA staff are involved with the working group that is overseeing the testing program.

Plastic Gas Venting

Last issue we reported on the situation in Ontario where the Ministry of Consumer and Commercial Relations issued an order to have plastic venting systems used in mid efficiency gas furnaces ((Ultravent, Selvent, and Plexvent) to be replaced. The Ontario New Home Warranty Program is currently covering all builder claims, but it is reviewing the situation and it plans to launch a class action law suit when appropriate.

The Canadian Gas Research Institute is still investigating alternative cost effective solutions to vent replacement.

New Home Owner Manual

There has been much discussion about the need for a new up to date manual that can be presented to new home purchasers, to inform them about the new systems and products in their home. This should help them carry on appropriate maintenance and avoid callbacks.

CMHC has approved funding for such a manual, and other potential partners are being solicited.

TRC will be involved, and will have a role in developing the criteria for the manual. Work should be underway in the new year.

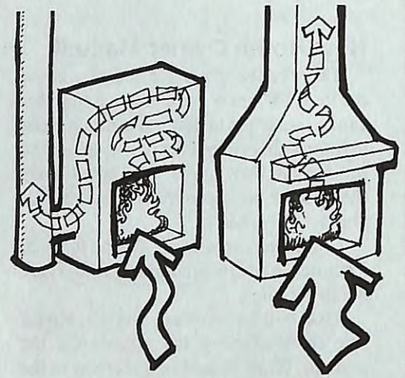
Internet

If anyone has come across any interesting construction related sites, let us know, and we will pass the information on to others. You can let us know by snail mail, fax, or e-mail (solplan@cyberstore.ca)

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector. If you have any problems, technical questions, or suggestions for areas that need to be investigated, you are encouraged to contact your local Home Builders' Association technical committee or the TRC directly at:

Canadian Home Builders' Association, Suite 200, 150 Laurier Ave. West, Ottawa, Ont. K1P 5J4
Tel: (613) 230-3060
Fax: (613) 232-8214

Masonry Heater Air Requirements



Wood has been used by humans as a fuel source for heat and cooking for thousands of years. Often, it's been not done very efficiently. Those picturesque open fireplaces we've grown up with (and see on Christmas cards) are inefficient, and indeed not very safe.

Recently, masonry heaters common in Finland, Eastern Europe and Central Asia have been rediscovered in North America. Masonry heaters are wood burning appliances that have a large masonry mass that is used to store heat. A 10 to 20 kg wood charge and a 1 to 2 hour burn can yield continuous heat for 12 to 24 hours. Because the heat storage capacity makes a low heat output possible without having to resort to smoldering burns (ie., low burn rates), cordwood fuel is burned efficiently with very low emissions of atmospheric pollutants.

Although based on designs that are hundreds of years old, the operating characteristics of masonry heaters make them suitable for modern, energy-efficient housing. Masonry heater output levels (equivalent to .5 - 3.0 kW) are well matched to the typical heat load of the average new energy efficient house.

It is known that the traditional open fireplace has very large combustion air requirements. However, it is not clear how much air masonry heaters draw from the house during operation.

Combustion appliances in draft-free energy efficient houses have always been a concern, as any malfunction of the combustion venting can affect the health of occupants. That is why research was undertaken to find out how much air is needed. Air consumption data was obtained under a variety of operating conditions.

Five different contraflow type masonry heaters were tested. Originating in Finland, these are regarded as being the most fireplace-like of the masonry heaters, and are the most common type built in North America. They usually have a raised firebox and set a of downdrafting heat-exchange channels that terminate in a chimney exit at the floor level (not above, as is common in standard fireplaces).

Masonry heaters with overfire combustion air systems appear capable of operating with a maximum air consumption rate of 30 L/s or less, while the underfire air units (combustion air brought into the firebox from below through a grate in the firebox floor) required considerably more air. In a typical R-2000 house, indoor air drawn out at a rate of 30 L/s can cause about 3 Pascals (Pa) of depressurization, well within any house depressurization limits.

When the heaters were fitted with a separate outside air supply, the only air from the house would be the air leakage through the doors. Testing on several doors showed that the leakiest door would draw only 6 L/s at 25 Pa, an amount that would not cause any noticeable degree of house depressurization.

A major concern with wood heating devices is that the chimney flow may reverse when the fire dies down, causing smoke and/or carbon monoxide spillage into the room. This is especially the case if the chimney is outside the building envelope, where it will cool faster. Tests showed that this is not an issue with masonry heaters, as the basic design stores large amounts of heat that will maintain the chimney draft even after the fire subsides. The thermal flywheel effect of stored heat in a high mass chimney can help to maintain the draft. In addition, a masonry heater is typically located inside the heated envelope, so most of the chimney will be warm.

Most masonry heaters are site-assembled and are usually accepted under the masonry fireplace and chimney provisions of the building code.

For several years codes have had a requirement for an outside air duct vented directly into the firebox of masonry fireplaces, but there can be problems with this. Recently, there have been several documented cases of complete draft reversals in factory-built fireplaces where a reversal has caused the air supply to become a chimney and the chimney has become the combustion air supply. For example when there is wind loading on a house, the windward side sees a positive pressure while the three leeward sides see a negative pressure which can easily exceed 50 Pa which can be enough pressure to overcome the chimney draft.

The study found that the majority of masonry heater types can be expected to function properly in airtight houses, with or without outside combustion air supplies.

Air Requirements and Related Parameters for masonry Heating Systems by: Norbert Senf, Masonry Stove Builders prepared for: The Research Division Canada Mortgage and Housing Corporation

Odds 'n Ends

Envirosafe Cabinets, the Vancouver based cabinet maker that puts a priority on environmental responsibility and health issues has reorganized their operation, and they are relocating to new premises. Their new phone number is (604) 299-7921.

Development standards. Affordable housing and the impact of new residential development on the environment are both matters of concern to all. The Regional Municipality of Ottawa-Carleton in Ontario with the Ottawa-Carleton Homes Builders' Association got together with utilities to determine the feasibility and desirability of changing development standards for subdivisions.

They looked at alternative planning and engineering standards in such areas as right-of-way width, lot dimension, house-to-house separation and infrastructure provision. The result? Potential savings in site-servicing and land costs of up to about $12,500 per unit for single-family homes and $5,500 per unit for multi-family homes. Actual cost savings would depend on the specific characteristics of an individual project.

In February 1993, a project using these alternate standards was approved by the city of Gloucester. Initial indications are that average savings of $4,000 per unit were achieved. The project will be monitored for five years.

Integrated heating packages. Today's energy efficient houses have very small energy loads, so that it is appropriate to use the hot water tank to provide both hot water and space heating. This approach is effective, as it provides both functions in a neat, compact package.

Lennox is the first supplier that has been marketing and integrated packaged system (the Compleatheat). Unfortunately, it's too bad that a great idea is presented in a flawed package. **Warren Jones** of Cortez Energy Efficient Homes tells us he's used the system, but he's found a couple of problems that the manufacturer is not keen on addressing.

The unit comes with conventional motors, not an ECM motor (the most advanced fan motor technology currently on the market), so as a result the overall energy efficiency is not as high as it could be. The problem with a less efficient motor unit is that there are times of the year (e.g. summer) when you don't need air circulation, but you still have a water demand. What Warren has found is that because of the inefficiency of the fan motor, and the low heat requirements of the house, the house is overheating.

The second major problem is with the control strategy. It seems that you can't turn off the fan. If you do, it also shuts off the domestic hot water function.

Foam Insulation Recycling. How to recycle the expanded polystyrene insulating foam widely used for everything from protective packaging and roof insulation foam to structural wall and roof panels? The durable qualities that have made expanded polystyrene (EPS) ideal for both packaging and home insulation have created a problem when it comes to disposal. Currently, polystyrene has no value to anyone after is initial use; in fact, it becomes a burden because it must be discarded at a cost.

The New York State Energy Research and Development Authority has commissioned research consultants to see if the foam can be reground and re-mixed with virgin materials and still retain the insulating quality and strength that have made it so popular.

If successful, this project will turn used polystyrene into a marketable product for a Buffalo, NY manufacturer, reducing material costs and providing it with a competitive edge. ☼

CHBA-BC '95 Georgie AWARDS BRINGING EXCELLENCE HOME

Gold for The Great Canadian Reno-Demo Project!

Last issue we told you that The Great Canadian Reno-Demo Project (the renovation of an 80 year old house in North Vancouver that demonstrates environmentally responsible, energy efficient and healthy home approaches to home renovations) had received two Silver Georgie Awards. The awards program was established by the Canadian Home Builders Association of B.C. to recognize excellence in the residential construction sector in British Columbia. Judging is done anonymously by a panel of judges brought in from outside the province.

The results are now available. During the gala awards presentation mid-October, the project was awarded a Gold Georgie for **Best Environmental Achievement.** ☼

Demonstration Projects

Many advances in housing technology are introduced by way of demonstration houses, either as stand alone projects or as part of more structured programs, such as the recent Advanced Houses Program in Canada. Some have large sponsors (and budgets), others are more modest efforts. This month we highlight a few demonstration projects that show the range of the projects that are being undertaken.

Timber-Tech House

A compact urban infill home in an older neighbourhood of Missoula, Montana has just been completed by **The Centre for Resourceful Building Technology**. The demonstration home is designed and built to be space efficient, energy efficient and resource efficient. It highlights advances in engineered wood products now available to the building industry.

The design is a craftsman-style house to blend in with the existing houses in the neighbourhood. An open floor plan featuring long views and ample daylighting makes the house seem larger than its 966 sq. ft. Large closets and built-in storage make effective use of available space.

The project is an example of resource efficient building practices. It features reused wood, wood-based composite materials and engineered lumber throughout. These use smaller pieces of wood and waste wood, practices which help to reduce the demand for new solid-sawn dimensional lumber from large-diameter and old-growth trees.

Floors are framed with floor trusses, wall studs are finger-jointed stock, window and door headers are engineered wood I-beams. Exterior siding and trim are wood composites.

Insulation in the walls and roof is cellulose, (recycled newspaper). The doors throughout the house have cores made from moulded sawdust.

The house exhibits quality used wood in high-visibility applications, such as hardwood flooring and interior trim. The maple floor was once the basketball court of a high school gymnasium, and the fir window sills and window seat used to be bleachers in that same gym. The baseboard and door trim are milled out of hundred-year-old wood salvaged from a commercial remodelling project.

Resource efficient and recycled materials that are currently available were used to show what can be done today. Builders will be familiar with many of the products but not all may be used frequently in all regions. The project is designed with the hope that ideas will be picked up and used by others.

For more information :
Centre for Resourceful Building Technology
Box 100, Missoula, MT 59806
Tel: (406) 549-7678

The Energy Showcase Project

Energy efficient demonstration projects are not unique to Canada. An energy efficient, ecologically sound demonstration house that is going to be part of a UK advanced house program is to be built in Herefordshire. It will only consume 10% as much energy as a normal new home and will obtain 85% of its energy from the sun. Overall, it will consume 98% less fossil fuel than a normal new home.

The design reconciles many different priorities. On the one hand, it is a house design fit for the 21st. century - a time when the burning of fossil fuels may be curtailed or forbidden because of the environmental damage which they cause. With its slate roof and rendered walls, it will have many features seen in old Herefordshire cottages, which were built before the age of cheap fossil fuels and with local materials. The traditional homes also took advantage of south orientation, with small north windows to make the best use of the sun's heat in winter (although without the help of modern technology, from which this scheme will benefit). The windows will be the house's heating system!

An underlying concern is to address global warming. To halt such climate change, Western Europe has to reduce production of carbon dioxide (CO_2) by about 80% within 50 years (two generations).

This house will use so little fossil fuel that it will lead to zero net emissions of CO_2 measured over 50 years.

The Energy Showcase project is intended to be the most advanced energy-conscious dwelling in Europe and will take advantage of the sun to meet virtually all its energy needs, avoiding the need for fossil fuels. Solar cells will be integrated into the roof so the house will return more electricity to the utility grid than it consumes.

As well as being extremely energy-conscious, the construction materials will be chosen to cause minimum environmental impact. This is defined both in a local sense (they will be chosen to have no adverse affect on indoor air quality); and in a global sense (materials which cause damage to the ozone layer will be avoided). Wherever possible the aim is to avoid PVC, lead flashing, materials foamed with HCFs, urea-formaldehyde and similar glues, and wood preservatives.

Water for the house will be obtained from a well on site. Waste water will be returned to the site after treatment.

Information:
David Olivier, Energy Design Associates
1 Moores Cottages, Bircher, Leominster,
Herefordshire, England HR6 OAX

Alberta Sustainable House

1995 SESCI Autonomous House Award Winner

The Alberta Sustainable House has received the 1995 SESCI Autonomous House Award. The house is the home and office of architects Jorg and Helen Ostrowski and is the product of the Ostrowski's considerable experience with sustainable building practises and renewable energy technologies. The jury liked the integrated design approach used in this house.

The house is a three bedroom 169-square metre (1820 square foot) one-and-a-half storey slab-on-grade design located in Calgary. It is designed to be largely self-sufficient in energy and water, to conserve resources and to promote occupant health.

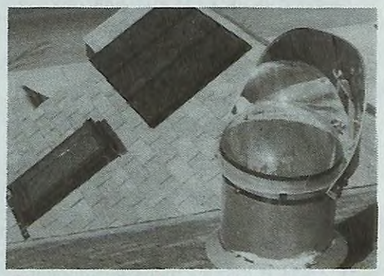
Features include R-55 wall insulation using recycled cellulose, R-17 window glass, and passive and active solar heating. A wood-fired masonry heater provides space heating, domestic hot water and cooking. An active thermal solar system provides a second source of domestic hot water and space heating.

The heat recovery ventilator (HRV) intake is located on the south wall to take advantage of passive solar preheating of the incoming fresh air. Water conservation measures include a large rainwater storage cistern and a composting toilet. Appliances are ultra-efficient.

The **SESCI Autonomous House Award** is sponsored by the Solar Energy Society of Canada to recognize houses that can show significant reduction in energy consumption and optimization of solar energy.

One requirement is that these houses have been occupied for at least one year. The proof of performance is at least one year's energy bills.

The winner will be receiving a cash award contributed by the following companies, who are dedicated to the promotion of energy efficiency and renewable energy use in Canadian Housing: **All-Weather Windows, Energy Alternatives, Photocom**, and **Willmar Windows**.



Close-up view of roof, with photovoltaic panels (solar electricity), along with top of light pipe.

For more information about the Autonomous House Award (it's not too early to think about entries for next year) contact Richard Kadulski at Solplan Review. For information about the Solar Energy Society of Canada,
Tel 613-523--974, Fax 613-736-8938
or e-mail: solar@worldlink.ca

Snap Together Plumbing Fittings

Traditional plumbing techniques too often have created unwanted work for the fire department. Hard to reach fittings are especially vulnerable to an errant blow torch!

The ACORN fitting, which has been on the market in Asia for ten years is now being distributed in Canada.

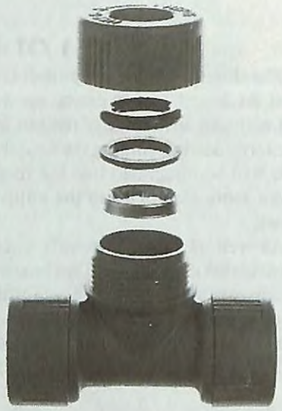
The plastic fittings, available in 3/8", ½," and ¾" pipe sizes, are designed for use with polybutylene, cross-linked polyethylene and copper pipe. They are suitable for use in hot and cold water plumbing as well as radiant heating.

What's so special about these fittings? The ACORN fitting is adaptable to copper, polybutylene, cross-link polyethylene and CPVC piping. This means simple connections with significantly reduced installation costs. They are very easy to use with all plumbing materials and can be installed without the use of special tools. All you need is a clean cut with no burrs or rough edges.

Attachment is easy. Just hold the fitting firmly, push the pipe in and tug back to ensure that an effective joint has been made. There are 2 points of resistance when making a joint. Built into the fitting are an 'O' ring, spacer, washer and grab ring. Once in place, the system can withstand all normal operating water pressures. If you need to make changes, the retaining cap is unscrewed, and the grab ring removed. Once removed the grab ring is discarded and replaced with a new one (it is never re-used).

Individually they may cost a bit more, but that should be more than compensated by the ease of installation, not to mention increased safety of installation.

Yes, they have CSA certification.



For information about ACORN fittings:
Plasco Manufacturing Ltd
Langley, B.C.
Tel: 604-530-9371
Fax: 604-530-3238

Letters to the Editor

Re: R-2000 Monitoring Data Review (Solplan Review, September 1995)

I noted with interest the R-2000 Monito ing Data Review. However, I find myself having a bit of trouble with the energy consumption data.

It looks as if the total average annual energy use is around 55,000 kWh/yr with non heating energy use at about 16,000 kWh/yr, which would leave around 39,000 kWh/yr for space heating. If that is true, the inference of 50% space heating reduction for R-2000 houses seems extraordinary, since it implies that conventional homes of a similar size uses about 77,000 kWh/yr for space heating, which is not the case for most homes.

Stephen Goudie,
Newfoundland & Labrador Hydro
St. John's, NF

On reading the September issue, I noticed inconsistencies in the numbers quoted in the R-2000 Program News. Space heat for the monitored houses is given as 261 MJ/m² (72 kWh/m²) which seems a little high. Does this also include hot water?

The total energy use quoted (150.6 kWk/day) appears to be about double the figure normally quoted for R-2000 houses. Is there an error here?

Terry Robinson
Scanada Consultants
Ottawa, ON

You are both correct to question the numbers. It appears that we missed a key note in the report. The figure for total energy consumption quoted (150.6 kWh/day) was only for a 7 month period over the heating season (October to April) and not for a full year.

The average measured energy consumption was approximately 19,000 kWh/yr (equivalent) for appliances, fans, pumps, exterior power, and domestic water, and 23,300 kWh/yr (equivalent) for space heating. The houses were significantly larger than the average conventional house, so as a result it is difficult to make a direct comparison.

The 50% reduction applied to only one of the houses in Edmonton (which had a space heat use of 16,000 kWh/yr).

As was stated, the sample size was very limited, and cannot be taken as a truly representative sample of all R-2000 houses, but it gives a good indication of the performance to be expected. Ed.

Re: "Surfing the net: a primer"

Great article; someday you may even be able to get information from the B.C. Building Standards Branch on the "net".

Watson J. Smith
Building Standards Branch
Victoria, B.C.

The Evolution of Building Materials

For thousands of years humans have mainly used five building materials: wood, stone, bone, horn and leather. Then came clay, wool, plant fibres, and metals. We are now in the age of custom materials - especially since the development of plastics (remember the advice that Dustin Hoffman received in the movie *The Graduate*?).

We now use materials that don't exist until the item they are a part of has been manufactured. Today's synthetic materials include a range of composite materials whose properties are designed to fit a specific need. The raw materials may be based on natural materials, but the end result is something entirely new.

The proliferation of materials is so great that a simple inventory is no longer possible, as any number of materials can be combined to achieve any desired specific objectives. This also creates new challenges when trying to evaluate products for a specific use as specifiers are facing an ever widening range of possibilities. For a given product, there are now several competing materials, some of which may be for very specialized applications.

The range of new materials is broad, and includes:

Organic materials: polymer mixtures such as ABS used mainly in piping; reinforced polymers containing glass or carbon fibres used in products such as textiles in roofing materials.

Wood composites such as plywood, pressed wood, glullam, timber strand as well as reinforced composites.

Multiple material composites: plywood, or pressed wood with a core of extruded polystyrene or rigid polyurethane foam used in building envelope sandwich panels.

Metal alloys and multimetals used for increased corrosion resistance. (e.g. for mechanical fasteners, roofing materials); surface treatments used to give metals special lubricant properties or improved abrasion and corrosion resistance.

Multiple materials that include a range of sandwich panels that combine wood, plastics or ceramics with metals.

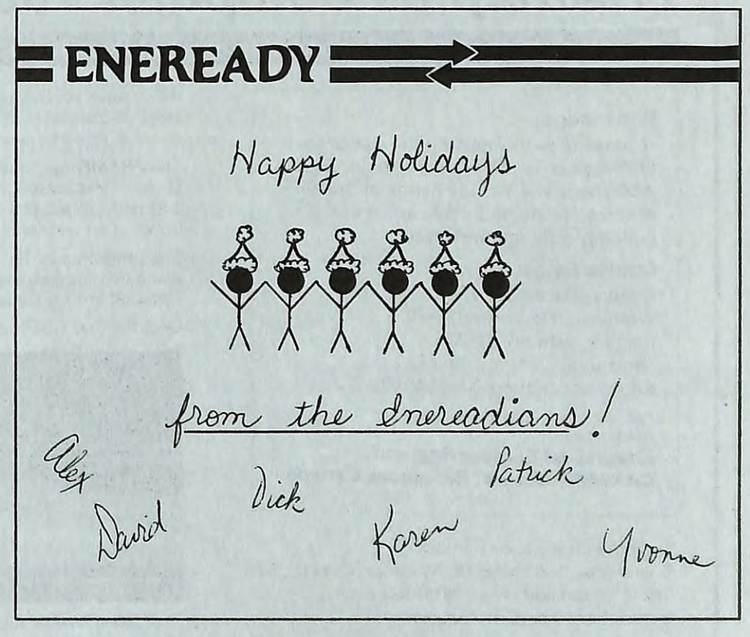
Mineral materials: cement-fibre composites (glues, metal and polymers) used as decorative or abrasion-resistant coatings for floors; resin concrete used as a waterproof coating

Electrochromic glazing used in semi-reflecting windows; high performance glazing used in commercial and residential windows.

Quality has replaced quantity, the key words being less material, less energy, more properties, right performance, greater functionality, more information. Life cycle, recycling and "zero waste" have recently become fully recognized criteria.

While we can engineer new products, caution must be exercised. New synthetic or composite materials are less easily reintegrated into natural cycles at the end of their useful life. Composite materials, almost by definition are non-recyclable, as they are the result of an almost irreversible combination of materials. This means that "decomposition" techniques will have to be designed into the products so as to make it possible to separate the various elements of composites. This is still a portion of the cycle that has to be refined. (Just think of the mountains of plastic packaging materials that are accumulating with no use is sight).

For the sake of sustainability, more emphasis has to be placed on the after life of materials. Much more effort has to be done, so it calls for care on the part of users to be careful when selecting new products. ☼



SECOND PRINTING

House Construction In B.C.

A guide to the B.C. Building Code

A simplified, illustrated guide to residential construction in B.C.explains Part 9 of the B.C. Building Code as it applies to residential construction. This 50 page reference uses imperial measurements and explains code requirements in plain language with sketches where appropriate.

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HOT 2000 (v 7.0) Data Input Forms

Our input data form has been designed to help users. The 4 page (8½"x11" format) single sheet has space to note principal inputs required by the program for average houses. Blanks are laid out in the sequence in which they appear when being entered, so you don't have to search through take-off sheets to look for the numbers you need.

- saves you time
- improves accuracy
- neat record of all inputs
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to calculate the thermal properties of windows, doors, walls and basements

Workshops
A series of workshops on the use of the FRAMEplus Toolkit are being held. The workshops will include hands-on training of the software and a discus-sion of building code requirements.

Course dates:
Ottawa, *December 13–15*
Winnipeg, *December 18–20*
Calgary, *January 10–12*
Vancouver, *January 15–17*
Kitchener, *January 31–February 2*

presented by
***Enermodal Engineering** and*
CANMET, Natural Resources Canada

for more information contact:
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If you have ever wondered about the performance of steel-stud walls, shallow foundations, insulating edge spacers, or curtainwalls, then this is the tool for you.

The ***FRAMEplus*** Toolkit can be used to determine the U-value and solar/optical properties of glazing systems and perform a 2-D heat transfer analysis of opaque building components.

The programs in the Toolkit are referenced in the CSA standards for windows and doors and in the 1995 National Energy Code.

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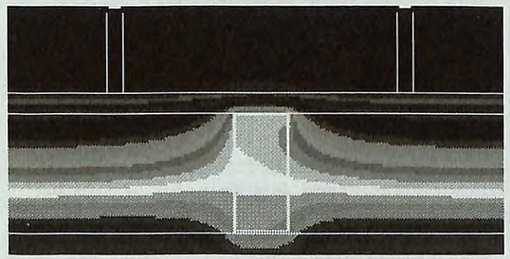

Heat flow through a steel-stud, brick veneer wall

Coming Events

January 13, 1996
Builders' Technical Forum: Technical conference and exhibit
Burnaby, B.C.
Tel: 604-432-7112 (or 1-800-933-6777)
Fax. 604-432-9038

January 17-18, 1996
Ontario Builder Forum: Technical conference and exhibit
Toronto, ON
Tel: 416-447-0077 Fax: 416-443-9982

January 26 - 29, 1996
The Builders' Show (NAHB Convention)
Houston, Texas

February 7- 14, 1996
7th International Winter Cities Conference
Winnipeg, MB
Tel 204-943-1970, Fax 204-942-4043

February 16-18, 1996
Construction Business & Technology Conference
Presented by the Journals of Light Construction
Marlborough, MA
Tel: 802-434-4747

February 17, 1996
Healthy Homes - Healthy Living '96: Homes Demonstrating EcoDesign Principles, Vancouver, B.C. A symposium on healthy building design sponsored by the Eco Design Resource Centre. Keynote speakers include Mark Bossert, Richard Kadulski, David Rousseau, and Karl Simmerling. For information call (604) 689-7622.

February 25-28, 1996
CHBA National Conference
Vancouver, B.C.
Info: Tel: 416-443-9023

March 4-6, 1996
Building Energy Hosted by the Northeast Sustainable Energy Association
Boston, MA
Tel: 413-774-6051 Fax: 413-774-6053

April 13 and 14, 1996
Tours to Vancouver area "Ecologically-Sound Commercial Buildings"
EcoDesign Resource Society (604) 689-7622 for more information.

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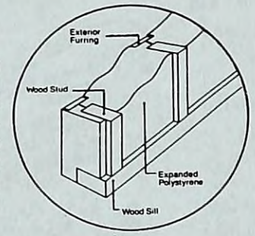

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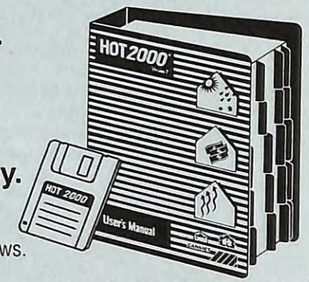

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